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CLASSIFICATION **SECRET**  
 CENTRAL INTELLIGENCE AGENCY  
**INFORMATION REPORT**

COUNTRY USSR

SUBJECT First Hand Observations on Soviet Capabilities in  
 Vacuum Tube Machinery and Vacuum Tubes/Access to US  
 Technical Data/Caliber of Soviet Technicians in the  
 Electronics Industry

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1. On 22 October 1946,  
 of Berlin.

an electronic firm in the Soviet Sector

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2.

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Tube Machinery Shop Within Soviet Vacuum Tube Center at Fryazino

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3. [redacted] the tube machinery shop [redacted] located within the Soviet Tube Center at Fryazino. This tube machinery shop which was separate from the rest of the plant was devoted to the design and prototype construction of specialized tube-manufacturing equipment, and included a vacuum tube model shop with the equipment needed for limited tube construction.

Number of Personnel Employed in Tube Machinery Shop

4. [redacted] in 1946 there were only twenty-five employees, but the shop kept expanding so that by the end of 1951 there were employed in this particular shop about one hundred designers and three hundred and fifty engineers or workers [redacted] the tube machinery shop at Fryazino.

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Training of Soviet Technical Personnel/Access to US Technical Data

5. Soviet engineers and technical personnel are well educated and well trained. [redacted] particularly impressed by the high grade work Soviet designers were capable of doing. Soviet engineers are continually studying and trying to improve their technical knowledge and to win academic degrees which will give them an opportunity to obtain better positions. They are given a 10% raise in pay for each foreign language in which they become proficient. All of the top Soviet electronics engineers speak English. They are entitled to continue their education and studies at Soviet institutions of learning until they reach forty years of age. Current patent drawings from all over the world and current foreign technical literature, particularly from the United States, are available to Soviet electronics technical personnel. Twenty-five different technical periodicals from the United States related to electronics were available some within six months of their publication in the United States. [redacted] the fact that the 1949 edition of the 1200 page book by Saul Dushman of the General Electric Company, Semiconductors, was translated into Russian, with a supplement on new Soviet improvements, and distributed in the USSR by 1950. Five or ten copies of this Soviet translation of Dushman's book were used by the personnel in the tube machinery shop at Fryazino [redacted] there were 20,000 copies of the Soviet translation of Dushman's book printed and were available at 100 rubles apiece in Moscow. Soviet technical personnel who used the book in their work obtained the book free. [redacted] Soviet technical personnel have a better knowledge of US developments in electronics than some US technical personnel. [redacted] a concrete illustration of the effectiveness of Soviet education.

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[redacted] more advanced subjects in mathematics, physics, chemistry and botany in USSR in the 8th grade than were taught in the 9th grade in Germany.

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Materials for the Production of Electron Tubes

6. In 1947 the supply of specialized production materials for the manufacture of electron tube and tube machinery was very limited, but by 1951 this picture completely changed. Tungsten and molybdenum and vacuum melted copper were in good supply. Stainless steel and duraluminum sheets were available in quantity for use in tube machinery. The aluminum alloys were of unusually good quality and were available in large sizes. Good technical glass was available.

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General Procedure and Method of Design and Manufacture of Prototype Tube Machinery

7. A Soviet government agency would establish requirements, including specifications, for some new type of tube machinery. There was at hand a plentiful supply of different types of foreign tube making machinery, [redacted] It was practice in the tube machinery shop to select and copy the best parts from [redacted]

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the foreign machines available, and then try to combine them into a machine which would be better than any from which the parts had been selected. After the design of a machine was completed, we would construct a machine which would be used as a prototype for large scale production of the machine elsewhere in the USSR. Sometimes, however, if the Soviets were particularly pleased with a certain foreign machine they would just have it copied completely. [redacted] completely a German bench spot-welder.

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#### Some Machines Designed and Built

8. Some of the machinery which we designed and built in the tube machinery shop at Fryazino was as follows:

- a. Copies [redacted] (single-turret sealing and exhaust machines) units.
- b. Sealing and exhaust machines modelled after late model Lerer equipment with separate 20 head exhaust and 24 head sealing turrets. The production or index speed of these units was 700 to 750 tubes per hour. Exhaust units were equipped with two stage oil diffusion pumps at each port. These pumps were copied from the model VMF5 oil diffusion pump [redacted]. The Soviets had an ample supply of the special type oil required by these pumps and other special type oils.
- c. Copies of [redacted] automatic grid-winding lathes.
- d. Good glass-blowing lathes, equipped with variable-speed drives similar to modern US units. (Soviet glass-working equipment was excellent.)
- e. Machinery for the manufacture of miniature tubes.
- f. Equipment for shock, vibration and acceleration tests. Tube testing centrifuges for use at 100 G's and 200 G's.

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#### Subminiature Tubes

9. [redacted] the task to design machinery for large quantity mechanized production of subminiature tubes of the smallest types using cylindrical bulbs and round button stems. After a few months, however, this project was dropped at Fryazino. [redacted] it is possible that this project was continued in Siberia.

#### Magnetrons

10. [redacted] to design a very large 100 kw controlled atmosphere brazing furnace. This furnace was probably for use in brazing operations in the manufacture of magnetrons. Vacuum refined copper of extremely high quality was available in quantity for the manufacture of magnetrons.

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#### Klystrons

11. The Soviets watched closely the development of klystrons throughout the world, and are probably in a good position relative to development and production.

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#### Reliable Tubes

12. [redacted] no specific indication of a "reliable" tube program as such. The Soviets, however, paid considerable attention to quality improvement and extensive work was done on all types, both mechanical and manual, of aging racks.

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Cathode Ray Tubes

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13. [ ] the design of mechanized equipment for the manufacture of cathode ray tubes, including conveyor screen-settling systems, sealing machines, and exhaust dollies. The major difficulty was that the size of the cathode ray tubes kept increasing faster than the machinery was built. The first equipment was begun for 7-inch tubes, then changed to 14-inch tubes, then to 17-inch tubes.

Plant Layouts

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14. [ ] the design of complete layouts "from blast furnace to bulb box" for vacuum tubes plants. The scope of these projects varied from a condensed summary of required facilities to completely detailed plans, including ten-foot architectural building sketches and floor plans. Such projects appeared to be in response to inquiries from planning groups, and did not necessarily indicate serious consideration of new construction. In 1951, one such new project was initiated in which the planned production capacity was of a magnitude so large as to seem to be unreasonable and illogical. However, considering the population of the Communist world it is possible that the Soviets seriously planned such a project. A serious industrial handicap seems to be the inflexibility and the excessive lead times inherent in the Soviet planning system. An important shift in the tube industry operations might require three years.

Fryazino Soviet Tube Center as a Whole

15. Because of Soviet security regulations [ ] of what went on in the electron tube installation at Fryazino was largely confined to what took place in the tube machinery shop in that installation. [ ] in other parts of the installation there was conducted research on, the design of, and the manufacture of a very wide variety of electron tubes, including receiving tubes, mercury rectifiers, cathode ray tubes and probably magnetrons and klystrons and other special-purpose types. [ ] there were in operation at this installation somewhere around ten complete tube-making units. [ ] rough estimate that there were employed between eight and ten thousand people in the entire Soviet Tube Center at Fryazino.

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Tube Machinery Manufacturing Plants

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16. [ ] the location of the plants in USSR which manufactured in quantity the tube-making machinery [ ] designed and for which [ ] built prototypes at Fryazino. [ ] one was located at Saratov and others may exist in Moscow, Leningrad and Novosibirsk.

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Tube Plants

17. [ ] Telefunken-type exhaust machines for the manufacture of tubes were located at Tashkent and Novosibirsk.

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